SIEMENS

PATENT
Attorney Docket No. 2003P07614US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Inventor:	R. Ruka et al.	Group Art Unit:	1745
Serial No.:	10/663,949	Examiner:	K. Walker
Filed:	September 16, 2003		

Title: PLASMA SPRAYED CERAMIC-METAL FUEL ELECTRODE

Commissioner For Patents
PO BOX 1450
Alexandria, VA. 222313-1450

Sir:

APPELLANTS BRIEF

This Appeal Brief relates to an appeal from the final rejection of claims 1-18 in the Office Action mailed May 2, 2006.

Real Party in Interest

This application is assigned to Siemens Power Generation, Inc. (f/k/a Siemens Westinghouse Power Corporation), a Delaware corporation having a principle place of business in Orlando, Florida. Siemens Power Generation, Inc, is a wholly owned subsidiary of Siemens Corporation of Iselin, New Jersey.

Related Appeals and Interferences

There are no prior and pending appeals, interferences or judicial proceedings known to Applicants, Applicants' legal representative, or Assignee which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

Status of Claims

Claims 1-18 stand finally rejected by the Office Action mailed May 2, 2006 and are presently under appeal in this proceeding. Claims 19-22 stand withdrawn from consideration for being drawn to a non-elected group.

Status of Amendments

No amendment has been filed subsequent to the final Office Action mailed April 10, 2006.

Summary of Claimed Subject Matter

Independent Claim 1

Referring to Figure 2, independent claim 1 recites a tubular solid oxide fuel cell 10, comprising:

an air electrode 14 (see e.g. page 8 line 5 - page 9 line 2);

an electrolyte 16 formed on at least a portion of the air electrode 14 (see e.g. page 9 lines 3-21); and

a ceramic-metal fuel electrode 18 having a microstructure characterized by accumulated molten particle splats formed on at least a portion of the electrolyte (see e.g. page 9 line 21 – page 10 line 17, page 15 lines 13-16).

Grounds for Rejection to be Reviewed

(1) Whether claims 1-4, 12 and 15-17, particularly independent claim 1, are unpatentable under 35 U.S.C. § 102(b) as being anticipated by Ramanarayanan (High Temperature Ion Conducting Ceramics).

(2) Whether claims 1-5, 7-10 and 12-15, particularly independent claim 1, are unpatenable under 35 U.S.C. § 102(b) as being anticipated by Clemmer (Influence of Nickel Distribution on the Processing and Properties of Porous Metqal/Ceramic Compoiste Fuel Cells).

(3) Whether claims 1-8 and 12-18, particularly independent claim 1, are unpatenable under 35 U.S.C. § 102(b) as being anticipated by Cable (USPN 5,589,285).

(4) Whether claims 5, 6 and 11 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Clemmer in view of what would have been obvious to one skilled in the art.

(5) Whether claims 5-8 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Ramanarayanan in view of Jensen (USPN 5,035,962).

(6) Whether claims 9-11 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Ramanarayanan in view of Clemmer further in view of INCO, Ltd website (www.incosp.com).

(7) Whether claims 13 and 14 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Ramanarayanan in view of what would have been obvious to one skilled in the art.

(8) Whether claim 18 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Ramanarayanan in view of Cable.

Specifically, if any of the prior art discloses a ceramic-metal fuel electrode having a microstructure characterized by accumulated molten particle splats formed on at least a portion of the electrolyte. Molten particle splats are formed by and an inherent characteristic of plasma spraying.

Appellants' Argument

Applicants' Invention

A fuel cell converts chemical energy directly into electrical energy. Most fuel cells comprise a cathode or air electrode 1 and an anode or fuel electrode 3, separated by an electrolyte 5 (Fig. 1). At the air electrode, oxygen is ionized and the oxide ions migrate through the electrolyte to the fuel electrode 3. At the fuel electrode 3, hydrogen is ionized and the hydrogen ions react with the oxide ions to form water and release electrons. The released electrons then travel from the fuel electrode 3 to the air electrode 1 through a load-containing connection, thereby completing the circuit and providing a small amount of direct electrical current. (spec. page 1 lines 15-22).

Because fuel cells are efficient, use plentiful and renewable fuels, do not require direct combustion and produce low emissions, they are a very attractive energy source. However, although the basic electrochemical processes and schematic arrangement of fuel cell based power generation systems are well understood, engineering solutions necessary to lower fabrication costs and make such systems an economical alternative to fossil fuel and other power generation systems remain elusive. (spec. page 2 lines 7-12).

One technical problem with conventional fuel cells involves the application of the fuel electrode to the electrolyte. The applied fuel electrode should advantageously possess and maintain certain properties during a lifetime of operation under fuel cell operating conditions with various fuels, including varying temperatures (e.g. about 25-1200°C, preferably about 700-1000°C) and pressures (e.g. about 0.5-5 atm, preferably about 1-5 atm). These properties include: high electrical conductivity, large electrochemically active interface area, high porosity, strong adherence to the electrolyte and interconnect, good chemical and physical stability, thermal cyclability, low fabrication costs, and long useful life. (spec. page 2 lines 13-21). Prior unsuccessful attempts to resolve this need are disclosed in spec. pages 2-4.

Applicants' invention resolves the need for a fuel electrode and a method for making the fuel electrode that can generally achieve above-described favorable technical properties and can be applied onto an underlying electrolyte at a low cost. (spec. page 4 lines 15-17).

Response to Rejections

(1) Claims 1-4, 12 and 15-17 stand rejected under 35 U.S.C. § 102(b), the Examiner contending that these claims are anticipated by Ramanarayanan.

Applicants' claims recite a tubular solid oxide fuel cell comprising a ceramic-metal fuel electrode having a microstructure characterized by accumulated molten particle splats. Ramanarayanan does not teach or suggest a fuel electrode having a microstructure characterized by accumulated molten particle splats (which would be caused by plasma spraying), as contended by the Examiner. Rather, Ramanarayanan page 24 first paragraph discloses that the anode (fuel electrode) is deposited by electrochemical vapor deposition (EVD), not plama spraying.

Ramanarayanan page 23 last paragraph discloses that the electrolyte is deposited by EVD, and mentions that depositing the electrolyte by more cost-effective non-EVD techniques, such as plasma spraying or colloidal/electrophoric deposition followed by sintering, is being investigated (but not by whom). Applicants respectfully submit that Ramanarayanan's passing reference to an investigation into plasma spraying the electrolyte is not an enabling disclosure because it does not teach how to plasma spray the fuel cell electrolyte onto the underlying cathode. See MPEP 2121. For example, no spray parameters are provided or even hypothesized. For another example, no indication as to how the adherence, thermal stability, cyclibility etc. properties are achieved. Moreover, for at least these same exemplary reasons, Ramanarayanan's passing reference to the electrolyte certainly does not enable how to plasma spray the fuel electrode onto the underlying electrolyte.

(2) Claims 1-5, 7-10 and 12-15 stand rejected under 35 U.S.C. § 102(b), the Examiner contending that these claims are anticipated by Clemmer.

Clemmer discloses the influence nickel distribution has on the microstructure, porosity, sintering shrinkage, coefficient of thermal expansion, and electrical conductivity of porous nickel/yttria-stabilized zirconia composite fuel electrodes. Clemmer does not teach or suggest a fuel electrode having a microstructure characterized by accumulated molten particle splats (which would be caused by plasma spraying), as contended by the Examiner. Rather, Clemmer

page 320 Experimental Procedure fabricates the fuel electrode by tape casting suspension, not plama spraying.

(3) Claims 1-8 and 12-18 stand rejected under 35 U.S.C. § 102(b), the Examiner contending that these claims are anticipated by USPN 5,589,285 (Cable).

Cable does not teach or suggest a fuel electrode having a microstructure characterized by accumulated molten particle splats (which would be caused by plasma spraying), as contended by the Examiner. Rather, Cable 8:30-35 teaches that a very thin fuel electrode interfacial layer 19, not the fuel electrode 4 may be formed by other techniques such as plasma deposition, spin casting, spraying or screen printing. Cable also goes into significant detail distinguishing its planar fuel cell design from the claimed tubular fuel cell design, explaining that its invention is directed to fuel cells which are tolerant of sulfur-bearing fuels (1:15-17) and that tubular fuel cells are intolerant of sulfur bearing fuels (1:25-30, 1:55-2:59).

(4-8) Dependent claims stand rejected under 35 U.S.C. § 103(a), the Examiner contending that these dependent claims are obvious over and in view of the various above identified references.

Applicants respectfully submit that none the cited references, alone or in combination, teach or suggest a fuel electrode having a microstructure characterized by accumulated molten particle splats (which would be caused by plasma spraying). Thus, the Examiner's identification of elements recited in the dependent claims cannot render the dependent claims unpatentable since the dependent claims include the limitations of patentable independent claim 1.

F. Conclusion

For the foregoing reasons, Applicants respectfully submit that the rejections set forth in the final Office Action are inapplicable to the pending claims. The honorable Board is therefore respectfully requested to reverse the final rejection of the Examiner and to remand the application to the Examiner with instructions to allows the pending claims. Please grant any extensions of time required to enter this paper. Please charge any appropriate fees due in connection with this paper or credit any overpayments to Deposit Account No. 19-2179.

Respectfully submitted,

Dated: 6/5/05

By: _____

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Claims Appendix

1. A tubular solid oxide fuel cell, comprising:

an air electrode;

an electrolyte formed on at least a portion of the air electrode; and

a ceramic-metal fuel electrode having a microstructure characterized by accumulated molten particle splats formed on at least a portion of the electrolyte.

2. The fuel cell of claim 1, wherein the air electrode composition comprises lanthanum manganite.

3. The fuel cell of claim 1, wherein the electrolyte composition comprises yttria-stabilized zirconia.

4. The fuel cell of claim 1, wherein the ceramic-metal fuel electrode composition comprises nickel and zirconia.

5. The fuel cell of claim 4, wherein the fuel electrode composition comprises at least 60% nickel and at least 15% zirconia.

6. The fuel cell of claim 5, wherein the fuel electrode composition comprises at least 70% nickel and at least 20% zirconia.

7. The fuel cell of claim 4, wherein the fuel electrode composition comprises no more than 85% nickel and no more than 40% zirconia.

8. The fuel cell of claim 7, wherein the fuel electrode composition comprises no more than 80% nickel and no more than 30% zirconia.

9. The fuel cell of claim 4, wherein a nickel graphite powder is used to obtain at least a portion of the nickel.

10. The fuel cell of claim 9, wherein the nickel graphite powder comprises at least 60% nickel and at least 15% graphite.

11. The fuel cell of claim 10, wherein the nickel graphite powder comprises at least 70% nickel and at least 20% graphite.

12. The fuel cell of claim 4, wherein a yttria stabilized zirconia powder is used to obtain at least a portion of the zirconia.

13. The fuel cell of claim 12, wherein the yttria stabilized zirconia powder comprises at least 7 mole percent of yttria.

14. The fuel cell of claim 13, wherein the yttria stabilized zirconia powder comprises at least 8 mole percent of yttria.

15. The fuel cell of claim 1, wherein the electrolyte composition comprises a solid oxide comprising a rare-earth element stabilized zirconia.

16. The fuel cell of claim 1, wherein the tubular solid oxide fuel cell further comprises an interconnect that interconnects a plurality of tubular solid oxide fuel cells.

17. The fuel cell of claim 16, wherein the interconnected tubular solid oxide fuel cells form a power generation system.

18. The fuel cell of claim 1, wherein the fuel cell further comprises a precursor layer formed between the electrolyte and the fuel electrode, the precursor layer composition comprising zirconia and having a thickness of about 5 um to about 20 um.

19. (withdrawn) A method of manufacturing a fuel cell, comprising:

providing an air electrode;

arranging an electrolyte adjacent the air electrode; and

plasma spraying a ceramic-metal fuel electrode powder onto at least a portion of the electrolyte with a plasma spray gun.

20. (withdrawn) The method of claim 17, wherein the powder has a gun feed rate of about 6 grams per minute to about 30 grams per minute, and a distance of about less than 4 inches between the gun and the electrolyte.

21. (withdrawn) The method of claim 17, wherein the spray gun has a discharge voltage of about 30-60 volts, a current of about 400-900 amperes, and a power of about 10-40 kilowatts.

22. (withdrawn) The method of claim 19, wherein the spray gun moves at a rate of about 400 mm/sec to about 700 mm/sec and the electrolyte makes about 2-40 revolutions around the spray gun to form the fuel electrode.

Evidence Appendix

None

PTO/SB/17 (12-04v2)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL for FY 2005

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT	($) 500

Complete if Known	
Application Number	10/663,949
Filing Date	09/16/2003
First Named Inventor	Roswell J. Ruka
Examiner Name	Keith D. Walker
Art Unit	1745
Attorney Docket No.	2003P07614US

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify) : _____

☒ Deposit Account Deposit Account Number: 19-2179 Deposit Account Name: Siemens Corporation

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☒ Charge any additional fee(s) or underpayments of fee(s) Under 37 CFR 1.16 and 1.17 ☒ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
		Small Entity		Small Entity		Small Entity	
Application Type	Fee ($)	Fee($)	Fee($)	Fee($)	Fee($)	Fee($)	Fees Paid ($)
Utility	300	150	500	250	200	100	____
Design	200	100	100	50	130	65	____
Plant	200	100	300	150	160	80	____
Reissue	300	150	500	250	600	300	____
Provisional	200	100	0	0	0	0	____

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims	Extra Claims	Fee($)	Fee Paid ($)
____ -20 or HP=	____	x ____	= ____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims	Extra Claims	Fee($)	Fee Paid ($)
____ - 3 or HP=	____	x ____	= ____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims	
Fee ($)	Fee Paid ($)
____	____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof	Fee ($)	Fee Paid ($)
____ - 100 =	____	/ 50 = ____ (round up to a whole number) x	=	____

4. OTHER FEE(S)

	Fees Paid ($)
Non-English Specification, $130 fee (no small entity discount)	____
Other (e.g., late filing surcharge) : Fee for Brief in Support of an Appeal	500

SUBMITTED BY

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Name (Print/Type)	JOHN P. MUSONE		Date June 5, 2006